



University of Pennsylvania
ScholarlyCommons

Master of Environmental Studies Capstone Projects Department of Earth and Environmental Science

August 2006

The Junior Ecologist Program

Katera Y. Moore

University of Pennsylvania, kymoore@sas.upenn.edu

Follow this and additional works at: http://repository.upenn.edu/mes_capstones

Moore, Katera Y., "The Junior Ecologist Program" (2006). *Master of Environmental Studies Capstone Projects*. 6.
http://repository.upenn.edu/mes_capstones/6

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements for the Degree of Master of Environmental Studies 2006.

Advisor: Sarah A. Willig

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/mes_capstones/6
For more information, please contact libraryrepository@pobox.upenn.edu.

The Junior Ecologist Program

Abstract

The purpose of this paper is to describe the Junior Ecologist Program (JEP), an informal science education program that I am developing for implementation at the John Heinz National Wildlife Refuge at Tinicum. The design of JEP is a synthesis of my Master of Environmental Studies education, which is at the intersection of landuse, natural science and public education. JEP is based on ethnographic and human development research and is being designed as an outreach program to the Eastwick community. At present, the Refuge is disconnected from the community. Creating a program that targets adolescents in the neighborhood can serve as a mechanism to attract local residents into the building while allowing the Refuge to become part of the community.

Comments

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements for the Degree of Master of Environmental Studies 2006.

Advisor: Sarah A. Willig

The Junior Ecologist Program

Prepared for the John Heinz National Wildlife Refuge at Tinicum



Katera Y. Moore

National Science Foundation Graduate Research Fellow



Master of Environmental Studies Capstone Project

The University of Pennsylvania

August 2006

Capstone Advisor: Sarah A. Willig, PhD

Acknowledgements

This is all through the grace and mercy of the Creator, who brought the following people into my life.

Susan E. Gill, PhD

For her guidance, support, and advice – I could not have come this far without her.

James F. Keller, Jr.

For his ongoing words of encouragement, and for sticking with me for the long haul.

Sarah A. Willig, PhD

For helping me to maintain my momentum.

Najwa Smith

For her invaluable assistance.

Zoë Warner

For her editing expertise.

Julie Johnson

For keeping me on task.

Kate McManus & Erika Scarborough

For providing me with the opportunity to “plan”.

Dionne Brown

For being not only family, but also a friend.

My Family

My husband Brian and my two children Amatullah and Sufyaan
for their support, understanding, cheers and prayers.

I also would like to thank all of my professors and friends that have supported me along this journey.

Table of Contents

Introduction.....	4
Program Philosophy	4
Research Foundation: <i>Statement of Need</i>	6
Program Description.....	12
<i>Mission</i>	12
<i>Program Structure</i>	13
<i>Targeted Audience</i>	14
<i>Setting</i>	15
<i>Goals</i>	16
Program Standards	17
Conclusion	19
References.....	20
Junior Ecologist Program Summer Curriculum Description	21
Week 1 – Getting Acquainted.....	21
Week 2 – Natural Systems (upland)	22
Week 3 – Natural Systems (wetland).....	23
Week 4 – Human Interactions	24
Week 5 – Landuse induced hazards	25
Week 6 – Urban Environmental Issues.....	26
Week 7 – Food.....	27
Week 8 – Human Ecological Considerations	28
Closing Ceremonies.....	29
Sources: Lesson Materials	30
Appendix A	i
Summer Program Proposed Budget.....	ii
Junior Ecologist Program Position Descriptions	iii
Recruitment Schedule	iv
Junior Ecologist Program Announcement.....	v
Summer 2007 Nomination Form.....	vi
Summer 2007 Application Packet.....	vii
Junio Ecologist Program Parent Letter	xvi
Appendix B	i
Rubrics	ii
Field Observation Guide	iii
Neighborhood Maps	v
A Sense of Place.....	vi
Reclaiming the Land.....	ix
Darby Creek Watershed Tour	x
A River Runs Through It.....	xv
The History of Garbage - Timeline	xvii

Introduction

The purpose of this paper is to describe the Junior Ecologist Program (JEP), an informal science education program that I am developing for implementation at the John Heinz National Wildlife Refuge at Tinicum. The design of JEP is a synthesis of my Master of Environmental Studies education, which is at the intersection of landuse, natural science and public education. JEP is based on ethnographic and human development research and is being designed as an outreach program to the Eastwick community. At present, the Refuge is disconnected from the community. Creating a program that targets adolescents in the neighborhood can serve as a mechanism to attract local residents into the building while allowing the Refuge to become part of the community.

I will begin by describing how my experiences as an informal science education program assistant informed my proposed approach to relevant science enrichment programming. I will then use the literature as it relates to human development as a rationale for JEP's design. This will be followed by a description of JEP's mission, structure and goals. I will end with an alignment of JEP to science program education standards.

Program Philosophy

Having conducted research as a participant-observer when I served as an assistant at both the Women in Natural Science (WINS) and Garden Mosaics programs, I was able to draw on the strengths of these programs when structuring JEP. The WINS program is a science enrichment program housed in one of the nation's leading research institutions, The Academy of Natural Sciences, in Philadelphia, PA. The program is a collaboration between The Academy and the School District of Philadelphia and is designed to introduce underserved girls to the sciences. WINS combines classroom instruction, hands-on activities and field trips as a means of

introducing urban students to the wonders of the natural world. Students who participate in the WINS program are generally recommended by their school and then complete a competitive application process. The program is structured as a summer program that continues as an afterschool program for one academic year.

Garden Mosaics was an Extension Service youth summer program that aims to "connect youth and elders...to investigate the mosaic of plants, people, and cultures in gardens, to learn about science, and to act together to enhance their community." Garden Mosaics operated as a subset of the Summer Park Management Program (PMP). The program is held at the Cobbs Creek Community Environmental Education Center and is a six-week vocational summer program for high school students to study and combat environmental issues in Cobbs Creek Park. The Garden Mosaic students traveled to a community garden where they conducted inquiries to learn about gardening practices. The goal was build relationships with the gardeners and conduct Action Projects to assist the gardeners. Unfortunately, there was no effort made to pursue anything other than the inquiries. Students simply provide proof of working papers and select Cobbs Creek as their summer work location and are paid the minimum wage for participation. Building on this monetary incentive, JEP will offer a weekly stipend to students to offset the costs associated with participating in the program.

WINS is an established well-structured program that covers "science in the city" topics ranging from energy to food. Ideally Garden Mosaics attempts to connect youth to the community and is less exclusive and can operate with fewer funds than WINS. JEP attempts to merge the program structure of WINS with the ideals of Garden Mosaics to create a program that provides engagement and accountability along with a vocational component. However, I found neither of these programs had an action component that truly instills a sense of belonging to a

place. While many of the concepts introduced were made concrete through fieldtrips, students did not necessarily relate the concepts as something relevant to their lives. Therefore, I went beyond these models to incorporate such a component because it is developmentally appropriate for the target audience and has the potential to underscore the academic concepts introduced through JEP. The core of JEP is science education; however, the action components are interdisciplinary. The projects connect to geography, literacy, and other academic areas as described in the syllabus. Another key difference between JEP and the model programs is the policy of ongoing assessment, which is crucial to be certain that the program is meeting its stated goals. Rubrics have been created for JEP's embedded assessments. These assessments include:

- Student self-reflection in a program journal
- A mid-program poster project that highlights what has been learned about natural systems before the program moves on explore the human impacts on these systems
- Student portfolios
- Teacher program journal and collaboration with the Refuge Environmental Education Development team.

Research Foundation: *Statement of Need*

Erik Erikson's Theory of psycho-social development identified Eight Stages of Man (Muss, 1996). Erikson posits in each stage there is a conflict that marks the turning point in development and a shift into the next stage. For Erikson, the development of an "identity" is paramount, thus the period of early middle childhood/early adolescence is second only to infancy in terms of developmental significance. During this period, children undergo significant changes to their physical, cognitive, social, and emotional structure, and it is also at this time that they form their identity. Adolescence marks entry into stage five—Identity vs. Confusion. Erikson asserts that the attempt to answer the question – "who am I?" is the most significant conflict of the stages of development. In stage five, adolescents question how they fit into their world and struggle to determine how they will have their opinions heard.

The majority of the literature about human development and out of school time acknowledges that families, schools, and communities each impact youth development in various ways. An adolescent's environment can foster or discourage positive development; thus peer relationships, academic achievement, and a sense of purpose are crucial during this period. For example, adolescents need to feel competent: a sense of industry yields satisfaction, pride, interest, and positive academic achievement; whereas a sense of inferiority yields task-avoidance, downheartedness, and negative academic achievement. Adolescents need some autonomy—a sense of autonomy will produce individuality, curiosity, interest, and self-regulation of conduct whereas a sense of shame or doubt will produce compliance/defiance, boredom, worry, and rule transgressions. As adolescents negotiate the need for relatedness they can feel trust, a sense of belonging, love, and positive relationship; a negative negotiation can produce mistrust, isolation, withdrawal, loneliness, hostility and ultimately alienation (Muss, 1996). Thus JEP strives to be a program that is inclusive and safe, promoting competence and appropriate autonomy.

However, it seems identity formation is mainly of concern when a child is at risk for potential delinquent behavior. But, this period is important for all young people because it is in these formative years that the attitudes and values of adulthood first form, particularly regarding issues of trust, dependence, competence, and control. Students' interactions with their immediate environment—school, home, peers, and community—impact their development (Bronfenbrenner, 1993). Though adolescents need activities that enhance rather than hinder this period of development, children from under-resourced areas often do not have interactions that stimulate engagement with their environment. The problems faced by youth “are exacerbated by the fact that traditional youth development programs rarely address the ways in which young

people deal with these issues and often ignore how these issues impede their healthy development” (Ginwright and James, 2002). Many youth programs fail to consider the relationship between active participation and positive development. Programs often attempt to meet broad goals and fail to address the developmental changes that occur during early adolescence to promote positive self-image and academic performance.

The old model for youth programs is a nurturing/mentoring approach with the idea that youths must be guided to the “right” path. The focus has been on the adult leader’s input rather than facilitation, which will enable youths to find activities that will promote self-initiated discovery and participation—this emphasis is largely the result of traditional ideas about education and the limited value we place on input from those whom we consider subordinate. As Friere (2000) writes in *Pedagogy of the Oppressed*, education is often teacher-focused and follows a banking model where the bank-clerk (teacher) deposits information into the receptacles (students). Friere argues that this style of education keeps the oppressed, oppressed, but “problem-posing” education liberates the oppressed because it is a process that considers the human consciousness (2000). Giving early adolescents a voice and promoting self-initiated pursuits can be more successful in stimulating the development of a positive self-image and helping youths wrestling with role confusion in stage five of Erikson’s hierarchy.

Some might argue that youth do have a voice, particularly in school, under the auspices of student council and class committees. But, when are their voices heard? Can planning the prom and other activities positively impact their educational and personal development? This kind of school-sanctioned youth participation is inauthentic. However, meaningful youth participation is essential, especially when we consider David Labaree’s notion (1997) that civic capacity originates in schools. In “Public goods, Private Goods: The American Struggle over

Educational Goals", Labaree states one of the principles behind the first schools was citizenship-training to create republicans to build a nation. Labaree concludes public education produces political competence to achieve one of the major goals of education: democratic equality (1997). Going back to these models, it is clear that we must equip adolescents with the tools needed to become informed citizens and future decision makers. In "The Role of Education in Democracy", Maxine Greene (1988) summarizes this notion concisely, "Surely it is an obligation of education in a democracy to empower the young to become members of the public, to participate, and play articulate roles in the public space".

This type of identity-building educational program that enhances citizenship does exist. For instance the Ecole d'Humanité, founded by Paul Geheeb, is an international boarding school that focuses on community and rigorous student-driven education. This institution creates a space for youth to express their concerns and gives them power to act. Ecole d'Humanité provides a model that encourages development during this crucial stage. Students plan their education programs with a key component of this comprehensive program being social action/community service ("Ecole"). Through self-exploration youths can determine what is important to them in their community, which will enable them to develop meaningful community interests and foster connection and productivity rather than alienation and insignificance.

Ginwright and James (2002) examine the concepts of alienation and insignificance in "From Assets to Agents of Change: Social justice, organizing, and youth development." Ginwright and James's article introduces the many negative ecological influences on urban youth, specifically examining social problems as they relate to youth's inability to develop a voice that will be recognized by the larger society. It explores the political, economic and social action (social toxins) faced by urban youth that lead to isolation, oppression, and exclusion.

Based on a social ecology perspective of youth, Ginwright and James assert that not only are youth negatively impacted by the ills of society, but policy has also done nothing to alleviate these issues: the tendency has been to either blame or dismiss these youths. They address the isolation of marginalized youth (urban youth of color) to explain how and why youths are beginning to mobilize and develop their own voices. Though many urban youths have access only to low wage jobs and virtually no higher education, Ginwright and James conclude these economic factors combined with the fact that youth are alienated, oppressed, and have no voice will eventually lead to social mobilization.

Ginwright and James use historical examples to support their claim of the unavoidability and effectiveness of youth in action. These examples include: demonstrations around the issue of civil rights in the United States, such as 1960s lunch counter sit-ins in the segregated South; demonstrations against apartheid in South Africa, specifically with regard to Bantu education; and numerous walk-outs in the United States around educational policy that adversely affected them. I personally experienced the force of social mobilization when my fellow high school classmates and I organized walkouts to protest the district's offer to provide Senior School (an emergency measure for seniors during a teacher strike) instead of negotiating a fair contract for the teachers. These examples are evidence of the "long tradition of youth taking leadership in social movements fighting for democracy and justice" (Ginwright and James, 2002).

Ginwright and James conclude by providing two theoretical frameworks through which to organize this social psychological discussion. The first framework is based on the work of Watts, Williams and Jagers (2003), who present an ecological approach concerned with sociopolitical development and young people's response to oppression. The second framework, developed by Ginwright and Cammarota (2002) is also ecologically focused and introduces the

social justice youth development (SJYD) theory. The underlying principles of SJYD are: analyzing power in social relationships, making identity central, promoting systemic social change, encouraging collective action, embracing youth culture, and acknowledging social issues. The outcomes of SJYD include: fostering democracy, promoting an awareness of how forces limit and promote opportunities, and producing future civic leaders (which is certainly one of the underlying principles of public education). As marginalized youths become increasingly isolated, it is clear that devising quality youth programs should involve a return to these principles as well as the concepts of adolescent development.

In Critical Hours: Afterschool Programs and Educational Success Beth Miller (2003) stresses a need for quality youth programs, especially afterschool programs. Miller examines the fragile developmental period of middle childhood and considers the effects of working parents, the structure of schools (stage-fit), and the dangers that exist outside of the home, especially in urban areas. Miller believes successful programs promote greater engagement in learning and motivate students. Miller states middle school students in particular need programs that promote social competence, academic performance, and civic engagement, which can positively impact grades, self-esteem, interest, confidence, and truancy. A quality program will consist of activities that promote teamwork, problem solving, and community involvement.

Miller measures the quality of afterschool programs using a checklist approach. She introduces us to the various models and strategies of current “quality programs,” and addresses the issue of why some programs are beneficial and others fail. The National Research Council on Community-Level Programs for Youth (2002) has developed a list of eight features of a positive development setting: physical and psychological safety, appropriate structure, supportive relationship, opportunity to belong, positive social norms, support for efficacy and

matter, opportunity for skill building, and integration of family, school, and community efforts. A quality program will build on adolescent interests and allow young people to experience success and competence. However, the report does acknowledge that some programs do not work and provides the reader with yet another list of potential reasons why; barriers to success include staff turnover, inadequate facilities, and transportation (2003).

Perhaps the low level of adult political participation within urban communities is a result of the inability to participate in meaningful activities as adolescents when values and attitudes are formed. When considering both Erikson's theory and the historical examples submitted by Ginwright and James, it is possible to conclude that young people can understand the urgency of public problems and should test their values through action particularly because their "intellectual and emotional attentiveness to broad social questions is fueled in many cases by idealism, a hunger for belonging and a search for meaningful roles" (Sherman, 2002). Public participation is an effective tool for fostering youth development because it links the individual to institutions and the community while they master and apply skills and witness concrete change.

JEP creates a space in which students can explore their neighborhood and analyze the impacts of various levels of decisions. The goal of continued participation in JEP is to increase both environmental awareness and civic capacity.

Program Description

Mission

The Junior Ecologist Program (JEP), an academic science enrichment program at the John Heinz National Wildlife Refuge, seeks to provide students with an environmental science knowledge base and a link to their community. JEP attempts to connect students to their

environment to not only instill a sense of place, but to also provide a capacity for action. JEP fosters positive self-development by including a social action component that provides an opportunity for adolescents to develop competence and a strong identity that prepares them for the future. In addition, JEP has been developed on the principle that authentic learning is a reciprocal activity and provides an active model of learning that will allow students to negotiate the newly acquired information about natural systems. The action project component of JEP provides opportunities for adolescents to be industrious; autonomous in that they have input into the project; and relatedness through connecting with and taking a leadership role in their neighborhood.

JEP is designed for Philadelphia public school students from the adjacent Eastwick neighborhood. The mission of JEP is to target young adolescents who have fewer science-based educational opportunities, both in school and extracurricularly, to improve their science knowledge, critical thinking skills, and civic participation. The training will provide JEP students with a foundation necessary to participate in the broad field of environmental studies. Therefore, it is hoped that JEP alumni will stay involved with the Refuge beyond the Phase I and II programs by becoming neighborhood environmental ambassadors. Additionally, JEP will prepare alumni to mentor and teach future program participants, to serve as Junior Naturalists at area nature centers, and to pursue scientific study beyond secondary school.

Program Structure

The initial phase of JEP is a summer enrichment program for students entering ninth grade. Phase I introduces students to basic concepts about the ecology of natural and built environments. During these sessions, classroom instruction will be supported by action projects throughout the neighborhood. In the classroom, students gain exposure to basic scientific

concepts via lectures and exploration. The classroom learning is then supplemented by outdoor experiential action-based projects at sites within the Darby-Cobbs Watershed. The students who choose (and are eligible) to remain involved in the program after the summer session will continue with service learning projects in Phase II, which would focus on personal, academic, and vocational development. Phase II, a year-long afterschool program, would build on the summer program and allow students to apply previous science instruction. (Phase II would move forward based on adequate funding and interest.)

Targeted Audience

The Eastwick neighborhood was geographically and socially assessed by using various GIS mapping techniques, participating in community gatherings, and surveying members of the community. In addition 1300 flyers about the Refuge's family programs were distributed throughout the area in the Spring 2006. There has not been a wide response to this campaign. However, JEP may be a more successful mechanism for linking the community to the Refuge.

JEP seeks the student with demonstrated competency in science, but whose interest may have been stifled by a lack of engaging instruction. Therefore the ideal candidate will not necessarily be an exceptional science student. The program will give the students the opportunity to explore and fit into their own environment, thus providing them with a sense of ownership within the community. As environmental ambassadors, JEP students can share their knowledge with friends, family, and neighbors.

This program is designed to reflect the dynamics and needs of the surrounding community. In this 3,000-acre redevelopment area, there are not many opportunities for eco-recreation. Additionally, the majority of Eastwick lies within the floodplain, as it sits between the Schuylkill River and the Darby and Cobbs Creek basins. Thus, having a sense of connection

with the environmental, particularly regarding flooding and stormwater runoff, could prove to be useful for area residents. Using the habitats at the Refuge and in the neighborhood, students in this program will be able to investigate the impact of humans on the natural environment and develop an action plan to promote more awareness in their own communities.

Setting

In the name of progress, digging channels, depositing soil, and draining for agriculture have destroyed vast areas of marshland. The John Heinz National Wildlife Refuge at Tinicum was established in 1972 by Congressional mandate and is an example of a landform that was transformed from wasteland to resource in a period of 50 years. The 1200-acre Heinz Refuge lies in a highly developed and industrialized urban area in both Philadelphia and Delaware Counties. The Refuge is supported by three creeks and plays a vital role in the health of the Delaware River Estuary. There are six habitats within the refuge boundaries: creek, forest, impoundment (marshy pond), a temporary wetland area, freshwater tidal marsh, and upland field. JEP activities will focus on the two major upland habitats and two major wetland habitats, specifically the tidal marsh and the impoundment. The Refuge is managed primarily for migratory birds that travel along the "Atlantic Flyway," but there are also mammals and amphibians that call the Refuge their home.

Currently, the Heinz Refuge's environmental education (EE) program specializes in state-approved professional development for area educators. The Refuge offers ten nationally-known, state-sponsored EE-based professional development workshops and typically trains 200 teachers annually. The Refuge also hosts approximately 5,000 students annually, serving as an outdoor classroom for area schools, home-school groups, scouts, and summer camps. The Heinz Refuge is unique in that environmental education is part of its mission statement; unfortunately,

recreation is the primary public use of the refuge. Programming currently focuses on nature enthusiasts and teachers, expanding this focus can attract the community into the building.

Though the current professional development approach to environmental education implemented by the Heinz Refuge is a good model for a center with limited staff, this model needs to be repackaged to reach a wider audience. As part of the repackaging, JEP would relate the natural systems on the refuge to the built environment of the neighborhood to provide students with a meaningful laboratory experience. JEP is being developed because refuge decision-makers want to expand outreach to the surrounding community. Since the laboratory if “used properly...is especially important in the current era in which *inquiry* has re-emerged as a central style advocated for science learning” (NSES, 1996), decision-makers would like to harness the Heinz Refuge’s potential to become a learning laboratory for a variety of audiences. The idea is that the refuge can become a place where practical learning and demonstration occur to provide tangible examples for students. Additionally, the refuge will not only be a source for professional development for educators, but also a place of exploration for families.

Goals

JEP is part of expanding programming targeting families by coupling recreation and environmental education. The goals of JEP include the following:

1. To explain the functions of natural systems and their connections to the urban environment.
2. To provide opportunities for students to investigate the relationship between the natural and built environment.
3. To stimulate a sense of stewardship for natural resources.
4. To provide a working understanding of basic biological principles and scientific methods through inquiry-based teaching techniques and experiential learning.
5. To provide activities that foster personal achievement, communication skills, and cooperative group interactive skills.
6. To assist JEP students in identifying potential career paths and post-secondary education opportunities.

Program Standards

Over the past two decades, the accepted method of science learning has changed from one of formal, knowledge-based instruction to one of active, inquiry-based learning. Inquiry mode of science instruction transforms a classroom into a learning laboratory and gives students the ability to actively seek knowledge and develop critical thinking processes (Victor and Kellough, 2004).

The recent push for environmental education and development of standards stems from the multitude of global environmental tragedies and recognition that natural resources are being rapidly depleted. As of January 2002, the Pennsylvania Department of Education (PDE) published Academic Standards for Environment and Ecology, identifying educational targets to be met in the four, seventh, tenth, and twelfth grades. JEP meets many of these targets as outlined in the syllabus. Schools have attempted to meet these standards in various ways; however, informal science education provides more flexibility in meeting these standards because they do not have to contend with standardized tests and there is time to devote to a rich investigation of the subject material.

The Pennsylvania Center for Environmental Education and the EPA lists over a dozen environmental and nature centers that serve as field trip destinations in Philadelphia County alone:

- The Academy of Natural Science
- John Heinz National Wildlife Refuge
- Andorra Natural Area
- Morris Arboretum
- Awbury Arboretum
- Pennypack Environmental Education Center
- Cobbs Creek Community Environmental Education Center
- The Philadelphia Zoo
- Earth Force
- Riverbend Environmental Education Center
- Fairmount Water Works Interpretive Center
- Schuylkill Center for Environmental Education
- Historic Bartram's Gardens
- Wagner Free Institute of Science

These centers provide a range of educational opportunities that focus on natural resources, including horticulture, watershed stewardship, and wildlife habitat. For Eastwick, Heinz is the most accessible in terms of cost and location. While JEP is tailored to the Heinz Refuge, the skills acquired by the students can be transferred to any of these centers.

In addition to the PDE standards, the National Science Education Standards provide guidelines for the goals of school science, assessment, teaching, professional development, content, and program design. JEP aligns nicely with these standards and emphasizes varied learning opportunities, integration with other subjects, the relationship among natural science, and exploring the built environment and social issues. NSES delineates science program standards for formal science curriculum. Though it is an informal science program, JEP's framework meets a number of these goals as a complement to the formal science instruction JEP students would receive in their public school classrooms. JEP is most closely aligned with the following standards:

- *PROGRAM STANDARD A: All elements of the K-12 science program must be consistent with the other National Science Education Standards and with one another and developed within and across grade levels to meet a clearly stated set of goals.*

JEP's goals and expectations are clearly stated in the mission and philosophy. The units covering topics that are categorized as a sense of place, natural systems, and human interaction, follow these goals.

- *PROGRAM STANDARD B: The program of study in science for all students should be developmentally appropriate, interesting, and relevant to students' lives; emphasize student understanding through inquiry; and be connected with other school subjects.*

JEP emphasizes critical and logical thinking skills by introducing science concepts and processes through varied activities. Students will use inquiry to gather and interpret data and begin to seek explanations from evidence. While JEP's primary focus is on natural science, the program connects to Pennsylvania's academic standards for: Environment and Ecology, Science and Technology, and Geography.

- *PROGRAM STANDARD D: The K-12 science program must give students access to appropriate and sufficient resources, including quality teachers, time, materials and equipment, adequate and safe space, and the community.*

JEP will employ a middle-school science teacher who is familiar with the resources of the Refuge. JEP targets under resourced youth that may not have the opportunity to explore the natural and built environments in an academic setting. In addition, JEP offers the opportunity for collaboration among the students, access to quality resources, and a variety of instructional methods. The knowledge gained through participation in the JEP program can be applied to the student's neighborhood.

By design JEP addresses both educational standards and developmental appropriateness and will provide under resourced students an opportunity to flourish as environmental ambassadors and vehicles of social change and not simply as receptacles of information.

Conclusion

As an urban youth program, JEP sheds the traditional mentoring approach and attempts an approach at youth programming that encourages positive development when adolescents are in an identity-forming stage of development. The overarching goal is to combine environmental science elements with youth programming to present JEP students with vocational and academic possibilities that may have not otherwise been available. In addition, participation in the program will enable students to recognize their civic capacity. Finally, as an environmental education program, JEP will attempt to create greater alignment between the Heinz Refuge and the Eastwick neighborhood, for the purpose of encouraging the use of this underutilized resource as well as increasing environmental awareness and stewardship.

References

- Bronfenbrenner, U. (1993). The ecology of cognitive development: Research models and fugitive findings. In Wozniak, R. H. & Fischer, K. W. (Eds.), *Development in context: Acting and thinking in specific environments* (pp. 3-44). Hillsdale, NJ: Erlbaum.
- Committee on Community-Level Programs for Youth. *Community Programs to Promote Youth Development*. National Academies Press: Washington DC. Eccles J and Appleton G Editors.
- Ecole d'Humanité. The Spirit of Learning. Website <<http://www.ecole.ch/english/framesecolee.html>>
- Freire, Paulo. (2000). *Pedagogy of the Oppressed*. 30th Anniversary Edition. New York: Continuum. Chapter 2.
- Ginwright, S and James, T. (2002). From assets to agents of change: Social justice, organizing and youth development. *New directions for youth development*, 96, 27-46.
- Greene, Maxine. (1988). The role of education in democracy. *Educational Horizons*.
- Labaree, David. (1997). Public goods, private goods: The American struggle over educational goals. *American Educational Research Journal*. Vol 34, No 1 pp 39-81
- Miller, Beth. (2003). *Critical Hours: Afterschool Programs and Educational Success*. The Nellie Mae Education Foundation: Quincy, MA
- Muss, RE. (1996). Erik Erikson's theory of identity development. *Theories of Adolescence* (6th ed.: pp 42-57). New York: McGraw-Hill.
- National Science Education Standards*. (1996). National Academies Press: Washington DC
- Sherman, Robert F. (2002). Building young people's public lives: One foundation's strategy. *New directions for youth development*, 96, 65-82.
- Victor, E. and Kellough, R. (2004). *Science K-8 an integrated approach*. 10th Edition. Saddle River: Pearson.

Junior Ecologist Program Summer Curriculum Description

Week 1 – Getting Acquainted

The goal of this week is to start thinking about a *sense of place*. Students will become familiar with each other (form a cohort) and the areas that we will explore during the program, both on and off of the Refuge.

Day 1 – Who’s who? and Where are we?

- Icebreaker activity/Scavenger hunt
- Create a program scrapbook or journal: students will keep a journal or scrapbook highlighting their experiences in the program. It will include written reflections, drawings, photographs, etc. Today the students will choose from a variety of materials to construct their scrapbook and will make daily 15-20 minute entries. This book will be used as an evaluation tool. The program instructor will also make and maintain a journal.
- Overview of mapping and observations – grids, using sensory language, making comparisons, other things to think about. Have the students map their neighborhood (3 or 4 blocks). Look at aerial and birdseye photographs showing the refuge and its surroundings. (*see appendix*)

Day 2 – What is a Wildlife Refuge? (and why is it important)

- [Refuge video, tour, and outdoor basics– Kate McManus, Refuge Manager](#)
- Before the tour, have the students draw and describe what they think they will see. After the tour, compare what they predicted to what they observed. Return to discuss the tour and how students would give the tour to their friends and family.

Day 3 – What’s in a neighborhood?

- [Neighborhood hike and mapping](#)
- Introduce concepts of redevelopment/urban planning
 - [“A Sense of Place” \(see appendix\)](#)
- [Visit the Eastwick PAC office](#)
- Journal Entry: How does the Refuge fit into the neighborhood?

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
The Human Characteristics of Places and Regions 7.3.3.D Environmental Health 4.3.4.A	Basic Geographic Literacy 7.1.6.A	Basic Geographic Literacy 7.1.9.A The Human Characteristics of Places and Regions 7.3.9.A	

Suggested Lessons
Project Learning Tree “Planning the Ideal Community” p 239 Project Learning Tree “People, Places, & Things” p 318 Project Learning Tree “Earth Manners” p 378 Project WILD “Everybody needs a home” p 58 Project WILD “Beautiful Basics” p 59

Week 2 – Natural Systems (upland)

The goal of this week is to learn about upland ecosystems and how they function in a pristine environment as well as the benefits to humans.

Day 1 – *Species Spectacular*

- Biodiversity – indicators, etc. Possible lessons from Bio-Basics, WILD, Project Learning Tree.
- What are the upland animals of the Refuge? (Enviroptic pelt/skull box) posters of tracks and scat.
- Native and invasive species –plants

Day 2 – *Penn’s Woodlands*

- The benefits of forests – filtering water, air; materials
- Reflection – what is a tree?
- Possible guest speaker Pennsylvania Horticultural society

Day 3

- Invasive weeding on JEP's "adopted" Refuge site – coordinate with Kate and/or Brendalee

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
Human and Environment 4.8.4.C	Renewable and nonrenewable resources 4.2.7.B Threatened, Endangered and Extinct Species 4.7.7.B		Renewable and Nonrenewable resources 4.2.12.A Humans and Environment 4.8.12.A

Suggested Lessons
Project Learning Tree “Forest Consequences” p 138 Project Learning Tree “400-acre wood” p 217 Project Learning Tree “We all need trees” p 65 Project Learning Tree “Trees as habitats” p 102 Project WILD “Bottleneck Genes” p 172 Project Learning Tree “A Forest of Many Uses” p 135 Sustaining Penn’s Woods lessons

Week 3 – Natural Systems (wetland)

The goals of this week are to learn about wetland ecosystem as they relate to the area – tidal marsh, function in watershed, etc. If time permits, can talk about global wetland issues or even Hurricane Katrina

Day 1 – Marsh, Swamp, or Bog?

- Wetland overview
 - What is a wetland?
 - What are the different types?
 - What are the functions and benefits of a wetland – water filtering, materials
 - Wetland animals

Day 2 - History of the Tinicum Marsh

- From the Lenape to present day
- Tour of Tinicum/possible mapping exercise – note transformation from resort town to industrial hub
 - “Reclaiming the Land” (*see appendix*)
- Changing role of the US Army Corps of Engineers

Day 3 – Making the connection

- Poster project – considering what the students have learned thus far about natural systems and the water cycle, think about their neighborhood and the positives and negatives of human interaction/management

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
	Threatened, Endangered, and Extinct species 4.7.7.A The Human Characteristics of Places & Regions 7.3.6.C	Threatened, Endangered and Extinct Species 4.7.10.B Watersheds and Wetlands 4.1.10.D	Threatened, Endangered, and Extinct Species 4.7.12.A Watersheds and Wetlands 4.1.12.E

Suggested Lessons
Wonders of Wetlands “Wetland Metaphors” p 85 Wonders of Wetlands “Wetland Habitats” p 87 Wonders of Wetlands “Hydropoly” p 260 Refuge Environmental Education Development Team “People’s Interaction”

Week 4 – Human Interactions

The goal of this week is to connect land and water. To investigate the impact development has on natural processes. Students will build on the wetlands lessons to learn a little more about watersheds particularly since the Delaware Estuary has always been a “working” estuary.

Day 1 – Watersheds/hydrologic cycle

- “A Drop in the Bucket” – looking at the water cycle and the distribution/availability of freshwater in the world.
- Enviroscope
- Philadelphia Water Department “Let’s Learn About Water” activity book
- [Possible Delaware River Basin Commission or Partnership for Delaware Estuary guest speaker](#)
- [Personal water monitor/graph](#)

Day 2 – Landuse/urban water cycle

- Enviroscope/Refuge exhibits
- [Possible fieldtrip to Water Works interpretive center \(scavenger hunt\)](#)
- Introduction to landuse planning and suburban sprawl

Day 3 – Action: Darby Creek Watershed – Trip to Skunk Hollow

- Compare and contrast the character of the Darby Creek at its upper and lower reaches.
 - Notice development, landuse, and stream health.
 - Notice how “everyone lives downstream” – how upstream landuse impacts downstream water quality, etc.
 - Compare flood plain landuse at John Bartram Memorial Park and Rolling Green Park.
- [See appendix for trip plan](#)

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
Environmental health 4.8.4.D	Watersheds and Wetlands 4.1.7.B		Ecosystems and their Interactions 4.6.12.A

Suggested Lessons
Project WET “Every Drop Counts” p 307 Project WILD “Ecosystem Facelift” p 166 Philadelphia Water Department materials

Week 5 – Landuse induced hazards

The goal of this week is to consider some of the “natural” disasters (i.e. flooding, landslides, earthquakes) that are exacerbated as a result of landuse patterns.

Day 1 – Flooding

- Revisit the urban water cycle – impervious surfaces
 - What happens to stormwater?
- Hurricane Floyd – September 1999 (review John Bartram Memorial Park, Darby)
- The wetland as a buffer for Tinicum Township
- “Stormy Weather” video (Philadelphia Water Department)

Day 2 – Point source pollution

- Define point source pollution
 - What are the state/federal/municipal laws that relate to pollution
 - What agencies enforce this
 - Love Canal and the history of Superfund
- Pipelines, oil spills, mitigation
 - Pipeline transport
 - Accidents/spills/monitoring
 - Sunoco February 2000
 - Review news reports if possible
 - [Possible Sunoco guest speaker](#)
 - Mitigation
 - Define
 - Legislation
 - [Visit/explore Sunoco mitigation site](#)

Day 3 – Non point source pollution

- Define non point source pollution and how it relates to stormwater runoff and urban water cycle.
- [“A River Runs Through It” \(see appendix\)](#)
- [Action: Storm inlet stenciling and leaflet distribution](#)

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
Environmental health 4.3.4.B Environmental Laws & Regulations 4.9.4.A The Interaction Between People and Place 7.4.3.B	Watersheds and Wetlands 4.1.7.B Environmental Laws & Regulations 4.9.7.A The Interaction Between People and Place 7.4.6.A	Watersheds and Wetlands 4.1.10.B The Interaction Between People and Place 7.4.9.A	Ecosystems and their Interactions 4.6.12.C

Suggested Lessons
Project Learning Tree “Pollution Search” p 153 Project WET “Sum of the Parts” p 267 Wonders of Wetlands “Recipe for Trouble” p 199 Wonders of Wetlands “Over Hill and Dale” p 220 Project WET “Humpty Dumpty” p 319

Week 6 – Urban Environmental Issues

The goal of this week is to continue the consideration of the human impact to the environment. Particularly how development impacts temperature and waste production. It is at this point that student journals should thoroughly reflect on what they've learned and what their impact is.

Day 1 – Urban Heat Island

- What is the urban heat island
 - EPA definition: *Heat islands form as vegetation is replaced by asphalt and concrete for roads, buildings, and other structures necessary to accommodate growing populations. These surfaces absorb - rather than reflect - the sun's heat, causing surface temperatures and overall ambient temperatures to rise*
- How do forests regulate temperature and air quality (review week 2)
- What are the benefits of street trees?
 - Possible Fairmount Park guest speaker
 - “Live, Grow, Thrive in a GREEN Philadelphia” Pennsylvania Horticultural Society video
 - “Edens Lost and Found” video – Chicago case study
- *Action: Neighborhood exploration*
 - Use thermometers to measure the heat in the area. On the Refuge, along streets where there are trees, in open area (grassy and paved) and at Island & Lindbergh. Create poster of results.

Day 2 – Garbage – The Wastestream

- What happens to urban waste
 - “Modern Marvels: History of Garbage” History Channel video
 - *The History of Garbage - Timeline (see appendix)*
 - Landfills - Enviroscope
- Possible PRC guest speaker
 - Area landfills - *brief visit with Rob Allen, Contamination Specialist*

Day 3 – Garbage Project

- “Landfill in a box” – students create mini-landfills to examine what different treatments have on decomposition
- Students will also create a JEP landfill that will be used as the “trash can” for the remainder of the program. Students will monitor and chart what waste they generate and determine alternative means of disposal, etc.
- *Action: Darby Creek Cleanup or*
- *Action: Revisit storm inlets (or vacant lots in the area) to check dumping and clean up*

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
Environmental health 4.3.4.A	Environmental health 4.3.7.A	Environmental health 4.3.10.A	
Environmental health 4.3.4.B	Environmental health 4.3.7.B	Environmental health 4.3.10.B	

Suggested Lessons
Project Learning Tree “Field, Forest, and Stream” p 203
Project Learning Tree “A Peek at Packaging” p 361

Week 7 – Food

The goal of this week is to further connect students to the land since that is where food originates. Possible topics will include the seasonality of food and local produce. Students will reflect on the impacts of Agribusiness on the environment, economy, and health.

Day 1 – The origins of food

- Produce – plants are producers
- Agriculture
- GMOs and organics
- Possible Food Trust guest speaker

Day 2 – Gardening

- The connection to agriculture
- Victory Gardens
- Compost
- Community Supported Agriculture
- *Action: Visit area community garden – interview gardeners: practices, history; assist with weeding, etc.*

Day 3 – Reflection

- Analyze program landfill – remove compostable items. Weight/volume.
- Visit produce section of supermarket or a farmer’s market
 - Survey/scavenger hunt
 - What vegetables are familiar
 - Can students recognize the different plant parts – leaves, roots, tubers, stems

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
Agriculture and Society 4.4.4.A Agriculture and Society 4.4.4.C	Agriculture and Society 4.4.7.A	Agriculture and Society 4.4.10.A	

Suggested Lessons
Project Learning Tree “Pass the Plants, Please” p 77

Week 8 – Human Ecological Considerations

The goal of this week is to wrap up everything that was learned about natural systems and the interaction with the built environment. Students will be introduced to the concept of “walking lightly/ecological footprint” and “carrying capacity”.

Day 1 – Ecological footprint, carrying capacity

- Students will create posters to reflect on their ecological footprint. They will consider their favorite item and think about all of the resources that go into making that item (material, labor, energy, distribution).
- How economics affects ecological footprints and waste generation

Day 2 – Reduce Reuse Recycle

- Packaging
- Ways of reusing items at home. Products that reuse recycled items, such as the decking at the Refuge
- Recycling legislation
- Aluminum, paper, plastic
- [Visit Atlas Traders recycler](#)

Day 3 – Reflection

- Analyze program landfill – remove recyclable/reusable materials. Weight/volume.
- What are the nature’s recyclers?
- As a group, create an action list based on what was learned. What are 10 simple things you can do and how do they help the environment. What is the connection between people and the environment?

Educational Standards			
Grade 3/4	Grade 7	Grade 9/10	Grade 12
Humans and the Environment 4.8.4.C Humans and the Environment 4.8.4.D Environmental Laws & Regulations 4.9.4.A	Humans and the Environment 4.8.7.B	Humans and the Environment 4.8.10.A Humans and the Environment 4.8.10.B	

Suggested Lessons
Project Learning Tree “A Few of My Favorite Things” p 75 Project Learning Tree “Nature’s Recyclers” p 108 Project Learning Tree “Resource Go Round” p 350 Project Learning Tree “Our Changing World” p 375 Project learning Tree “A Look at Lifestyles” p. 401

Closing Ceremonies

- Present students with the Junior Ecologist Certificate and patch/pin
- Distribute laminated (desktop published) 10 simple things lists
- Unveil student exhibit – photos of action projects, poster boards, etc

Educational Standards demonstrated at closing ceremony
Rights and Responsibilities of Citizenship Quality of Writing Speaking and Listening

Suggested Lessons for preparing for the closing ceremony presentations and exhibit
Project Learning Tree “There Ought to be a Law” p 244 Project Learning Tree “Publicize It” p 256

Sources: Lesson Materials

American Forest Foundation. *Project Learning Tree - PreK-8 Activity Guide*. Washington, DC

Council for Environmental Education. *Project WILD -K-12 Curriculum and Activity Guide*. Houston, TX.

Edens Lost and Found. *Chicago City of the Big Shoulders*. Video

Environmental Concern Inc. *WOW! The Wonders of Wetlands*. St. Michaels, MD

The History Channel. *Modern Marvels: History of Garbage*. Video

PA Department of Education. *Sustaining Penn's Woods – A sound use of the land*. Harrisburg, PA

Pennsylvania Horticultural Society. *Live, Grow, Thrive in a GREEN Philadelphia*. Multimedia Presentation.

Philadelphia Water Department & Partnership for the Delaware Estuary. *Let's Learn About Water*.

Philadelphia Water Department. *Stormy Weather*. Video

Water Education for Teachers. *Project WET Curriculum and Activity Guide*. Bozeman, MT

Appendix A

- Program Budget
- Position descriptions
- Recruitment materials
 - Recruitment schedule
 - Program announcement
 - Program nomination form
 - Application materials
 - Parent letter

**Junior Ecologist Program
Summer Program Proposed Budget**

Expenses:**Labor**

Program Instructor	8,000
Program Assistant	4,000
Honorariums – Guest Speakers	500
TOTAL LABOR	\$12,500

NON-LABOR**Materials, Supplies, Services**

Laboratory supplies/instructional materials	1,500
Postage	600
Printing/Xerox – <i>brochures, recruitment materials</i>	500
Publication – <i>workbooks, handbooks</i>	250
Student stipends (<i>15 @ \$50/week</i>)	9000
Transportation (<i>2 fieldtrips</i>)	600
TOTAL NON-LABOR	\$12,450

TOTAL EXPENSES	\$24,950
-----------------------	-----------------

Junior Ecologist Program Position Descriptions

Program Instructor

Qualifications

- A bachelors degree with a teaching credential
- A minimum of three years teaching experience in an urban school system
- A working knowledge of the academic needs of under resourced students
- Interest in environmental and urban issues
- Strong interpersonal skills and strong organizational skills
- A genuine sensitivity to the needs of all children
- A professional attitude and manner that reflects the high standards of the program.

Responsibilities

- Attend JEP staff orientation/training
- Provide appropriate, intellectually stimulating instruction in each class by taking into consideration the unique abilities of each student.
- Interact with students, parents, and refuge staff
- Monitor the behavior of students, absenteeism, and tardiness.
- Maintain a program journal
- Meet with the Refuge Environmental Education Development team biweekly

Program/Teaching Assistant

Qualifications

- Minimum high school diploma, prefer a college sophomore with a major in environmental science, social science, or urban planning
- A strong commitment to education
- Interest in environmental and urban issues
- Strong interpersonal skills and strong organizational skills
- A genuine sensitivity to the needs of all children
- A professional attitude and manner that reflects the high standards of the program.

Responsibilities

- Attend JEP staff orientation/training
- Provide support to the program instructor
- Attend all field trips and neighborhood explorations
- Assist students with solving program related problems
- Maintain a program journal

Recruitment Schedule

<i>September/October</i>	<i>Program Marketing</i>	Participate in local school Back-to-School nights
<i>January</i>	<i>Program Announcement & Nomination Forms</i>	Send information to guidance counselors, science teachers, & community leaders
<i>February</i>	<i>Deadline for receipt of nomination forms</i>	Follow-up with parents & school contacts.
<i>March</i>	<i>Parent letters</i>	Send letters of congratulations to parents
<i>mid-March</i>	<i>Reminder letters</i>	Send letters to remind parents/students to complete the application
<i>April</i>	<i>Deadline for application materials</i>	Develop a system to check-in applications. Begin application review process.
<i>May</i>	<i>Finalist</i>	Notify applicants of their status.
<i>May/June</i>	<i>Orientation sessions & Interviews</i>	

Junior Ecologist Program Announcement

Program Description

The Junior Ecologist Program (JEP) is an eight-week summer program held at the John Heinz National Wildlife Refuge for rising 9th grade students in the Eastwick area that are interested in environmental issues. JEP is designed to guide students in gaining the scientific and outdoor skills necessary to understand and interpret the natural environment, particularly at the intersection of the built environment. Field-based learning experiences, focused on basic concepts in earth and life sciences, enable students to explore plant and animal communities in a remarkable outdoor classroom – the John Heinz National Wildlife Refuge at Tinicum.

The 1200-acre refuge is supported by three creeks and plays a vital role in the health of the Delaware River Estuary. There are six habitats within the refuge boundaries: creek, forest, impoundment (marshy pond), a temporary wetland area, freshwater tidal marsh, and upland field. JEP activities will focus on the two major upland habitats and two major wetland habitats, specifically the tidal marsh and the impoundment.

Program Highlights

- Learn the tools of a naturalist while studying natural systems, uplands, and wetlands
- Study ecological systems, including biodiversity and watersheds
- Enjoy the John Heinz National Wildlife Refuge's eco-recreation opportunities
- Investigate urban landuse issues
- Develop presentation skills

Eligibility

We are not only looking for "A" students. We recognize that certain circumstances can prevent some students from demonstrating their academic potential. **We encourage students of all abilities to apply.**

We are seeking students who are:

- Enthusiastic about the environmental sciences
- Interested in learning the investigative skills of a field scientist
- Interested in spending extended time outdoors
- Entering grade 9

Application Process

If you would like to nominate someone for JEP, please complete the attached nomination form and/or contact the refuge for an application packet.

Junior Ecologist Program
John Heinz National Wildlife Refuge at Tinicum
8601 Lindbergh Blvd.
Philadelphia, PA 19139
(215) 365-3118

John Heinz National Wildlife Refuge at Tinicum JUNIOR ECOLOGIST PROGRAM

Summer 2007 Nomination Form

July 2 – August 31, 2007

The Junior Ecologist Program is an 8-week summer enrichment program for rising ninth grade students at the John Heinz National Wildlife Refuge at Tinicum. The course is an academic and experiential learning experience that involves participating in outdoor classes, keeping a field notebook and conducting field research. Students from the Eastwick area will study natural ecosystems and explore the surrounding neighborhood.

JEP is an inclusive program aimed at providing opportunities to those students who might not otherwise pursue science. The selection process is based on academic potential, maturity and an interest in environmental and urban studies. If you know any students who might benefit from participation in JEP, please complete the nomination form below.

Your Name and Title: _____

School/Business: _____

Address: _____

_____ Email: _____

Student Name:	Student Mailing Address:
Student Name:	Student Mailing Address:
Student Name:	Student Mailing Address:

Please Return Completed Form by **February 15th** to:

Junior Ecologist Program

John Heinz National Wildlife Refuge at Tinicum

8601 Lindbergh Blvd.

Philadelphia, PA 19139

(215) 365-3118

John Heinz National Wildlife Refuge at Tinicum
JUNIOR ECOLOGIST PROGRAM
8601 Lindbergh Blvd
Philadelphia, PA 19153
(215) 365-3118
Summer 2007 Application Packet
July 2 – August 31, 2007

This packet includes nine numbered pages. Make sure you have a complete packet. Read each section carefully. If you provide handwritten responses, please write legibly.

Who are we?

The Junior Ecologist Program (JEP) is an eight-week summer program held at the John Heinz National Wildlife Refuge for rising 9th grade students in the Eastwick area that are interested in environmental issues. JEP is designed to guide students in gaining the scientific and outdoor skills necessary to understand and interpret the natural environment, particularly at the intersection of the built environment. Field-based learning experiences, focused on basic concepts in earth and life sciences, enable students to explore plant and animal communities in a remarkable outdoor classroom – the John Heinz National Wildlife Refuge at Tinicum.

The 1200-acre refuge is supported by three creeks and plays a vital role in the health of the Delaware River Estuary. There are six habitats within the refuge boundaries: creek, forest, impoundment (marshy pond), a temporary wetland area, freshwater tidal marsh, and upland field. JEP activities will focus on the two major upland habitats and two major wetland habitats, specifically the tidal marsh and the impoundment.

What does JEP offer?

- Learn the tools of a naturalist while studying natural systems, uplands, and wetlands
- Study ecological systems, including biodiversity and watersheds
- Enjoy the John Heinz National Wildlife Refuge's eco-recreation opportunities
- Investigate urban landuse issues
- Develop presentation skills

How will I spend my time?

The program is structured to make the most of the 8 weeks. JEP meets three days per week for five hours each day. We will work to broaden your understanding of the natural and social sciences. Classroom instruction is supported by hands-on activities, field trips, and neighborhood explorations.

How do I apply?

Fill out the attached application. Pay close attention to the instructions. **Applications must be mailed and postmarked no later than April 15, 2007. E-mailed applications will not be accepted or reviewed.**

Who should apply?

The following criteria will be used for selection:

- Enthusiastic about the environmental sciences
- Interested in learning the investigative skills of a field scientist
- Interested in spending extended time outdoors
- Entering grade 9

What if I am smart but have not gotten great grades?

We are not only looking for “A” students. We recognize that certain circumstances can prevent some students from demonstrating their academic potential. If you fall into such a category, **we encourage you to apply.**

What goes into my application?

A complete application should include the following:

- A completed **participant application form**
- A copy of your **most recent report card**
- **Two letters of recommendation** (one from a science or math teacher and another from a teacher, counselor, principal, or mentor.)

What is the process for selection? How many are chosen?

- The top applicants participate in a personal interview conducted by JEP or Refuge staff.
- Approximately 30 finalists are invited to participate in an orientation and group interview on **Saturday, May 19, 2007** at the refuge. **Fifteen** students will be selected for the program.

How am I notified about my status in the application process?

Everyone will be notified in writing about his or her status during the application process. **Final selection will take place by May 3, 2007.**

John Heinz National Wildlife Refuge at Tinicum
JUNIOR ECOLOGIST PROGRAM
Summer 2007 Participant Application
July 2 – August 31, 2007

NOTE: Apply only if you are entering ninth grade in the fall.

Please type (print in Black/Blue ink only if no typewriter or computer is accessible)

Personal Information

Name: _____ Current School: _____
 Home Address: _____ School Name: _____
 _____ School Address: _____

 Home Telephone: (____) ____ - _____ School Telephone: (____) ____ - _____
 Name and address of your school next fall: _____

 Science classes taken: _____
 E-mail: _____ In case we can't get in touch with you:
 Name of relative _____, relationship to you _____ Phone (____) ____ - _____
 Gender: ____ Birthdate: ____/____/____ Age ____ Number of years lived in Eastwick: _____

Family

Name of parent(s) or guardian(s): _____
Mother/Guardian: _____ **Father/Guardian:** _____
 With whom do you live (circle): _____ Mother? _____ Father? _____ Other Adult? _____
 Who is/are your primary caregiver(s)? _____
 Number of brothers and sisters (not including yourself): _____
 How many people live in your household? _____ List those people, their relationship to you, and their age:

 Have any of your relatives attended college? (If yes, which college, and did they graduate?)

Parents'/Guardians' Education

Check the highest year of schooling completed by your parent(s) or guardian(s)

Father/Guardian:

- ___ 4 year college diploma (BA, BS) or beyond
 ___ 2 year college diploma (AA)
 ___ High school diploma or equivalent
 ___ Some high school
 ___ Less than high school

Mother/Guardian:

- ___ 4 year college diploma (BA, BS) or beyond
 ___ 2 year college diploma (AA)
 ___ High school diploma or equivalent
 ___ Some high school
 ___ Less than high school

Parents'/Guardians' Occupation

(Specify under job title if parent is unemployed, disabled, homemaker, student, or describe other circumstances)

Father/Guardian:

Job title: _____
 Describe job duties: _____

Place of employment: _____

Income per year: _____

Please list all other sources of income and the amount (including those people who support you in and outside of your home): _____

Mother/Guardian:

Job title: _____
 Describe job duties: _____

Place of employment: _____

Income per year: _____

PLEASE ANSWER THE FOLLOWING QUESTIONS IN THE SPACE PROVIDED

1. Please list your high school extracurricular, community related activities, and past summer experiences, including caregiving responsibilities. Include the year of your involvement (i.e. 6,7,8) and your approximate hours per week. Please spell out acronyms. Please attach an additional sheet if needed.

<u>Activity</u>	<u>Year of involvement</u>	<u>Hours per week</u>

2. Does the high school you plan to attend offer IB (International Baccalaureate) courses? _____
 AP (Advanced Placement)? _____

3. Describe your typical weekday.

4. Describe one school, work, or volunteer experience during high school that has meant a lot to you. Why was this important?

5. What circumstance has had a major impact on your life? How has this experience affected you?

6. Why are you interested in participating in this program?

7. Briefly describe an environmental problem that is of concern to you.

8. What will you do this summer if you do not attend JEP?

I CERTIFY THAT THE ABOVE INFORMATION IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.
I give the Junior Ecologist Program permission for reasonable and proper use of any photograph taken of me or any written statement made by me during this program. I will be expected to participate in group activities and maintain an academic quality in my work commensurate with my abilities.

Student's Signature

Date

Parent or Guardian Signature

Date

John Heinz National Wildlife Refuge at Tinicum
JUNIOR ECOLOGIST PROGRAM
Summer 2007 Teacher Recommendation Form
July 2 – August 31, 2007

Name of student Applicant: _____

The Junior Ecologist Program is an 8-week summer enrichment program at the John Heinz National Wildlife Refuge at Tinicum. The course is an academic and experiential learning experience that involves participating in outdoor classes, keeping a field notebook and conducting field research. Students from the Eastwick area will study natural ecosystems and explore the surrounding neighborhood.

JEP is an inclusive program aimed at providing opportunities to those students who might not otherwise pursue science. The selection process is based on academic potential, maturity and an interest in environmental and urban studies. Recommendations from the student's teachers and/or mentor are more important to us than transcripts and lists of extra-curricular activities. We recognize that teachers are asked to fill out many recommendation forms and that limited time sometimes results in too-brief comments. However, your careful evaluation of this student is invaluable to us. All information furnished by you will be kept confidential. Your effort is greatly appreciated.

Your Name and Title: _____

School/Business: _____

Address: _____

_____ Email: _____

Business Phone: _____ Home Phone: _____

1. Under what circumstances have you known the applicant?

2. How do you rate the applicant's promise for this program as you understand it?

3. Please describe the applicant based on:

- Self-motivation and ability to work independently
- Social skills and cooperative behavior
- Academic achievement
- Emotional maturity and sense of humor
- Physical fitness
- Interest in science, outdoor experiences, and social issues

4. Other comments:

Please do not return to applicant

MAIL TO:

Junior Ecologist Program

John Heinz National Wildlife Refuge at Tinicum

8601 Lindbergh Blvd

Philadelphia, PA 19153

Recommendation must be received by April 15.

If you would like more information, please check the following:

- ☐ I would like to receive more information about JEP
- ☐ I would like information on teacher workshops and adult programs
- ☐ I would be interested in bringing a group of students to the John Heinz National Wildlife Refuge

Mail all materials, postmarked no later than **April 15, 2007**, to:

Junior Ecologist Program

John Heinz National Wildlife Refuge at Tinicum

8601 Lindbergh Blvd.

Philadelphia, PA 19153

Please direct any inquiries about completing this application to our Environmental Education Specialist, Erika Scarborough at Erika_scarborough@fws.gov.

Student Check List

Make sure you have sent all of the following materials together (in one envelope):

DOCUMENT

ENCLOSED

1. Participant application:
2. A copy of your report card
3. From whom did you request a recommendation letter?
 - a. One letter from a science or math teacher
 - b. One letter from anyone of your choice

Be sure to make a copy of your application in case there is a problem with the mail.
Application deadline – April 15, 2007.

More information? Please visit our web site at:
<http://www.fws.gov/northeast/heinz/welcome.htm>

JUNIOR ECOLOGIST PROGRAM PARENT LETTER

John Heinz National Wildlife Refuge at Tinicum
8601 Lindbergh Blvd
Philadelphia, PA 19153

March 1, 2007

Parent's of (student name)
(student address)
(student city state zip)

Congratulations! Your child has been nominated for participation in the Junior Ecologist Program at the John Heinz National Wildlife Refuge at Tinicum.

The Junior Ecologist Program is an 8-week summer enrichment program for rising ninth grade students at the John Heinz National Wildlife Refuge at Tinicum. The course is an academic and experiential learning experience that will allow students to study natural ecosystems and explore the surrounding neighborhood.

Program Highlights

- Learn the tools of a naturalist while studying natural systems, uplands, and wetlands
- Study ecological systems, including biodiversity and watersheds
- Enjoy the John Heinz National Wildlife Refuge's eco-recreation opportunities
- Investigate urban landuse issues
- Develop presentation skills

Eligibility

We are not only looking for "A" students. We recognize that certain circumstances can prevent some students from demonstrating their academic potential. **We encourage students of all abilities to apply.**

We are seeking students who are:

- Enthusiastic about the environmental sciences
- Interested in learning the investigative skills of a field scientist
- Interested in spending extended time outdoors
- Entering grade 9

Application Process

If you would like your child to benefit from the JEP experience, please complete the enclosed application and return it to us by **April 15, 2007**. We look forward to receiving your application.

Sincerely,

JEP Coordinator

Appendix B

- Rubrics
 - Student Journal/Field Guide Rubric
 - Instructor Program Journal Rubric
- Field Observation Guide
- Neighborhood maps
 - Street map
 - Digital Raster Graphic map
 - Aerial map
 - Topographic map
- “A Sense of Place” lesson plan
- “Reclaiming the Land” PowerPoint presentation
- Darby Creek Watershed Tour trip plan
- “A River Runs Through It” lesson plan
- "A River Runs Through It" PowerPoint presentation
- The History of Garbage - Timeline

Rubrics

Student Journal/Field Guide Rubric

This rubric is used as an indicator of program impact – to assess if program learning goals were met and how participation in JEP has impacted student behavior.

4	Well documented. Neat. Detailed observations (using sensory and action words) about wildlife, plants, and habitats. Comparisons to previous observations. Comparisons among the different habitats. Topic question answered thoughtfully. Apparent curiousness about the environment. Asks questions. Reflection of personal impact on ecosystem and watershed.
3	Neat. Clear observations about wildlife, plants, and habitats. Comparison to previous observations. Entries indicate increased observation details. Topic question addressed. Reflection of personal impact on ecosystem and watershed
2	Not neatly done. Observations take the form of inventory of what is seen. Topic question answered in less a few sentences. No reflection of personal impact.
1	Minimum observations. Topic question not answered or simply restated. No reflection of personal impact.

Instructor Program Journal Rubric

This rubric is used as an indicator of program impact – to assess teacher is meeting the expectation of engaging students.

4	Well documented. Detailed observations about student responses and group dynamics. Clear descriptions of program progress. Thoughtful reflection on performance as instructor. Indication of strengths and weaknesses. Suggestions for program improvement. Reflection of personal impact on ecosystem and watershed.
3	Detailed observations about student responses and group dynamics. Descriptions of program progress. Some reflection on performance as instructor. Suggestions for program improvement. Reflection of personal impact on ecosystem and watershed
2	Minimal observations about student responses and group dynamics. Brief listing of program activities. No reflection of instructor performance. No suggestions for program improvement. No reflection of personal impact.
1	Minimum information. Instructor seems unengaged.

Field Observation Guide

Date: _____

Remember that you are a visitor to the habitat of the creatures on the Refuge. Please enjoy the area, but leave no evidence that you were there.

Before you go out into the Refuge, think about what you might see and how you expect to feel. You can start by "I wonder..."

What is the weather? Sunny, cloudy, warm....

--

What do you smell? Does it smell stinky or fresh? Do you like the smell? What do you think it is?

What do you feel? Did you touch anything? How did it feel - rough or fuzzy, soft or hard?

How do you feel? What is like being on the Refuge? Are you happy, scared, excited, bored? Do you want to come back?

What do you hear? Animal sounds? Water moving? Leaves rustling?

Other observations

Date: _____

How big is it?
How does it move?
Can I measure or count it?
Can I touch it?
Does it look familiar?
Does it eat, or is it food?
Is it scared of me? Am I scared of it?
Do I like it?
Draw a map or picture of the area...
Is it living or non-living?
Does it live in, near, next to the water?
How does it fit into the ecosystem?

Neighborhood Maps

These maps can provide students with an introduction to the various types of maps available and allow students to get a spatial perspective of their relative location.

- Street map – Windows Live Local
- Digital Raster Graphic – USGS
- Aerial map – Windows Live Local
- Topographic map - TerraServer

A Sense of Place

Subject Area

Analyzing public space

Objectives:

Students will be able to:

- Understand the concept of city planning
 - Recognize key contributors
- Understand the geographic location of their neighborhood

Materials:

For this lesson you will need:

Flip chart/chalkboard for listing concepts

Neighborhood maps

Pre-Class Set-up:

This lesson involves a brief introduction to the concepts prior to going on the neighborhood exploration.

Discussion:

Ask students to *Name a Public Place that you enjoy going to*. Write their responses on the board. Look at the list and ask *What is special about these places or what do these places have in common?*

If anyone mentions places that are not public (such as malls), briefly explain why a mall is not a public space.

A *public place* is somewhere any member of the general public can be. Places such as malls or theaters are not public because they are private property that generally requires admission. A good clue to a non-public place would be No Loitering signs or some other indicator that a visitor should have a purpose for being in that location.

Once a public place is clearly defined, make lists about their likes and dislikes of these places and solicit ways to combat some of the dislikes.

Lesson

Introduce the concepts of space and place.

Space – Physical location

Place – Space that carries meanings for an individual or group

Ask the students what the phrase “*Sense of place*” means to them. Most often people think of a place that makes them comfortable or reminds them of something nostalgic to themselves. For example Germantown Avenue in Chestnut Hill has many of the qualities that David Sucher would consider a successful urban village (City Comforts). One thing that keeps Chestnut Hill’s property values so high is this nostalgic quality of a small town.

Contributors to city planning (source: City Reader)

Frederick Law Olmsted 1870 “Public Parks and the Enlargement of Towns”

- Considered to be the founder of landscape architecture Landscape architecture is the art and science of analysis, planning, design, management, preservation, and rehabilitation of the land. (www.asla.org)
 - Nature and the built environment
 - Urban planning – infrastructural and social
- Designed Central park
- Three moral imperatives
 - Improve public health by sanitation measures and the use of trees to combat air and water pollution
 - Combat urban vice and social degeneration
 - Advance the cause of civilization by providing urban amenities

Kevin Lynch 1960 “The Image of the City”

- 20th Century urban design
- Psychology and humanities
- How do people perceive their environments and how can design professional respond to human needs?

Jane Jacobs 1961 “The Death and Life of Great American Cities”

- Neighborhood activist – urban renewal creates slums
- Many people think that cities are not safe but Jacobs proposes that crowding is safer than parks. Crime is less likely to occur on a busy street than on an isolate sidewalk.
 - Eyes on the street – regular dwellers on the street that function as police. For example, the newsstand operator who is there everyday and sees everything.

William Whyte 1988 “The Social Life of small Urban Spaces”

- Urban society and planning
- Why are some parks and plazas well used and others empty?
- How to do urban research

Discussion/Evaluation:

A brief discussion before going on the Neighborhood Exploration will allow the instructor to determine if the students have grasped the concepts.

What are the similarities/differences among these four contributors?

Which theory do you like the best?

Do you see any evidence/influence of these theories in Philadelphia or in your neighborhood?

Looking for both positive and negative evidence ie NTI, blight, etc.

Create lists of the public places (most probably parks) in their neighborhood: good features and destructive aspects. Explore why these destructive aspects exist.

- Broken Windows Theory (Wilson & Kelling) – a public disorder theory that suggests that a broken window sends a message that nobody cares and if left too long, more broken windows will follow. They did an experiment by leaving an abandoned car in a neighborhood, slowly but surely people stripped and vandalized the car.

Reclaiming the Land

This PowerPoint presentation provides a simple overview of the history of the Tinicum Marsh – particularly the changing land uses. It also highlights the John Heinz National Wildlife Refuge at Tinicum as a good reuse of the damaged land.

This presentation can be used in place of or in conjunction with the REED "People's Interaction" packet.

Darby Creek Watershed Tour

Darby Creek begins in Tredyffrin Township (Chester County) and empties into the Delaware River. Northwest to Southeast flow.

There are 31 municipalities that impact the creek and 4 superfund sites within the watershed. This makes coordination of management efforts difficult. The watershed is 87% developed.

Development began in the lower end (downstream) of the creek and moved upstream. Trolleys and the PA railroad pushed development west from Philadelphia. The lower reaches of the creek are marked by more dense development, industrial uses, and some economical disadvantage. The waterfront is industrialized.

Although the lower end of the Darby creek has had more historical development and thus more evidence of the impacts of urbanization on the creek; upstream landuse also impacts the creek. Particularly in terms of nutrient load. Stormwater management issues begin upstream but travel along the many miles of impervious surface downstream.

Additionally, moving towards the headwaters of the Darby Creek provides a social transect as well – the character of the watershed's built environment changes as we move upstream.

The riparian buffer of the creek has been removed as the floodplains were paved and the wetlands filled. Upstream sediment flow and increased volume and velocity of runoff from urbanization also impair the creek.

Damaging flooding from Hurricane Floyd was experienced throughout the lower municipalities of the creek.

The majority of JEP activities focus on the immediate area of the Refuge to instill a sense of places. However, a study of watersheds causes one to realize that their place is connected to other places.

**Data: Darby Creek Valley Association Conservation Plan*

**Photos: Katera Moore*

Directions

From the Refuge will travel Hook Road to Calcon Hook Rd to Chester Pike to MacDade Blvd to Lansdowne Ave to 12th & Chestnut.

John Bartram Memorial Garden

Our first stop along the Darby Creek will be to the John Bartram Memorial Garden in Darby. Here students will be able to see the effects of building in a floodplain and get a feel for riparian zone erosion. Students will be given 20-30 minutes to sketch the area and write a reflection. It will be useful to have pictures of the area pre/post Hurricane Floyd and possibly have [former Mayor Paula Brown](#) meet the group at the site.



Figure 1 Darby Creek at John Bartram Memorial Park (looking south)

What is the significance of the no-mow zone? Think about the homes that once stood and the location of the park. Imagine the creek overflowing its banks into the floodplain. The park looks empty – what is its function?

Directions

Lansdowne Ave to Scottsdale Rd notice the creek on the left at Hillsdale Rd. Notice the built environment in Hoffman Park. Continue on Burmont Rd/Shadeland. Left on Marshall Rd. Right on Burmont Rd. Left on State Rd. Continue onto Township Line. Right on Rolling Road.

Rolling Green Park

A 9.2-acre natural environmental park.

How does this floodplain compare to Bartram? What is its function?



Figure 2 Darby Creek at Rolling Green Park (looking south)

Students will be given 20-30 minutes to sketch the area and write a reflection – paying attention to the change in the surrounding area as compared to Darby. Students can access the creek and check for macroinvertebrates and possible conduct water sampling tests.

Directions

Continue up Rolling Road/Parkway Ave. Right on Eagle Road. Follow Burmont Rd. Left on Glendale Road. (Depending on time, students may elect to stop at Merry Place on Glendale Road). Left on West Chester Pike.

Follow West Chester Pike up to Route 252. Left on 252. Right on Sawmill Road (just past Goshen Rd). Follow Saw Mill, notice topography and change in built environment.

Pass Saw Mill Park, go over bridge and turn left at Darby-Paoli road. Turn left into the Willows.

The Willows/Skunk Hollow

The Willows is a 47-acre estate and Skunk Hollow is a 93-acre undeveloped area.

Take note of the Little Darby Creek and the constructed lake/pond. *How does this relate to the impoundment at the Refuge?* The reed bed is a constructed wetland use to keep the pond clean. *How does this relate to the function of the Refuge's tidal marsh?* Possibly link with [Banny Ackerman/Jon Savitch \(Radnor Middle School Watershed Program\)](#).

Take the Yellow Trail into Skunk Hollow. Explore the upland habitat and walk along the creek. Pick a spot and sketch and reflect.



Figure 3 Little Darby/Big Darby Creek at Skunk Hollow (looking north)

Skunk Hollow and The Willows are parks managed for recreation. How do they differ from the Refuge, which is managed for fish and wildlife?

While exploring, notice the invasive species. Check creek for macro invertebrates.

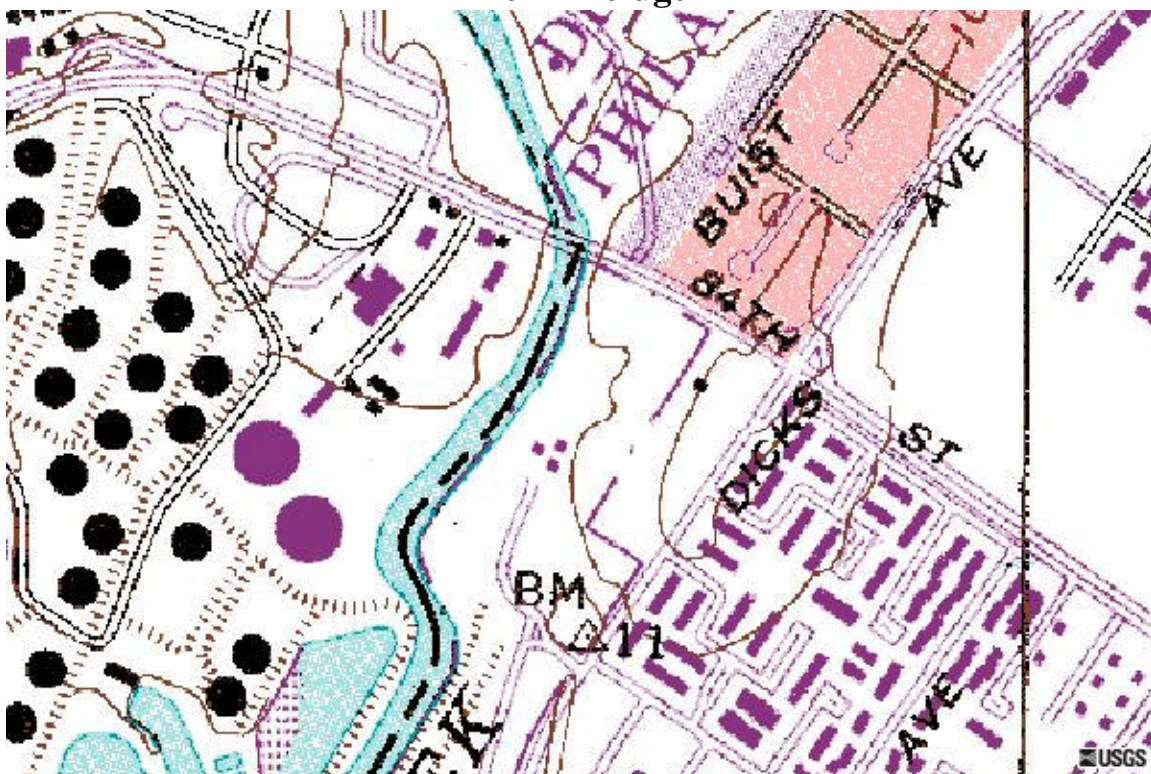
Finish up at the Willows for a picnic lunch.

Directions

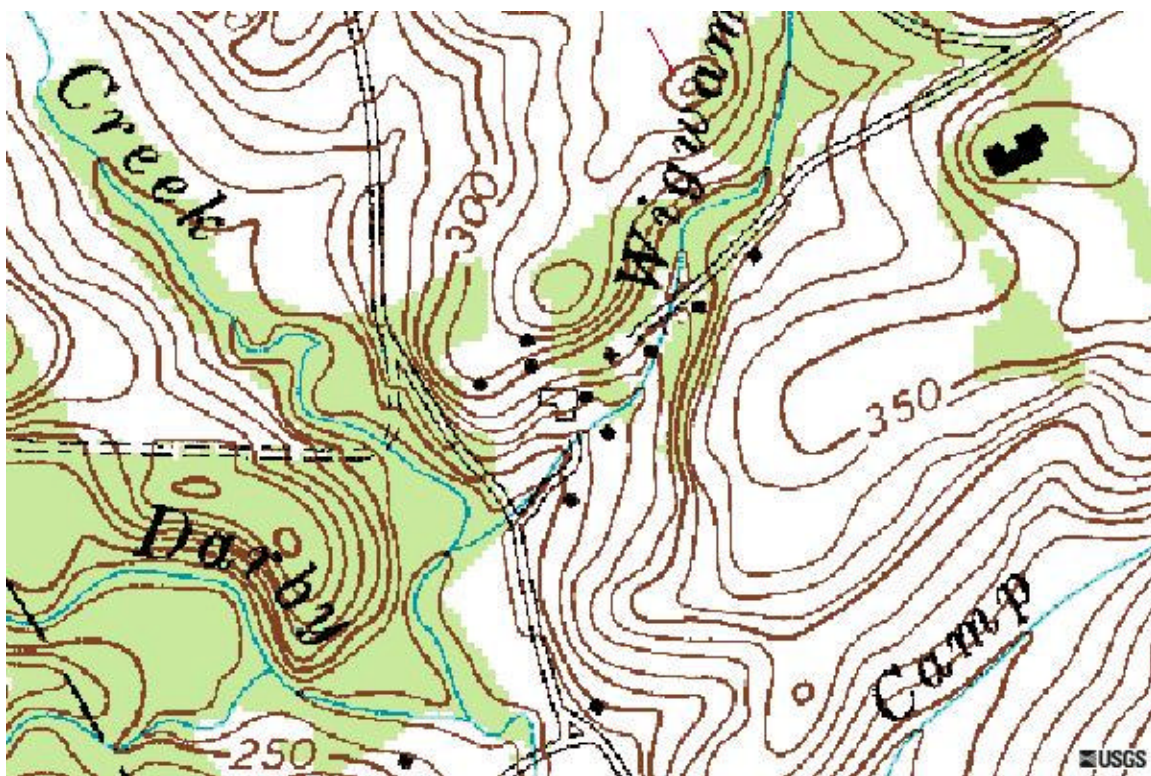
Exit the Willows on Darby-Paoli Road. Left on Bryn Mawr Avenue. Right on Sproul Road. Continue on Darby Road. *Notice the change in density as you travel down Darby Road. Note that all of this land drains into the Darby Creeek/Refuge.*

Compare and contrast the topography of the area surrounding the Refuge and the area at The Willows.

Heinz Refuge



The Willows



A River Runs Through It

Subject Area

Water management – the long term impacts of man imposing on the environment

Objectives

Students will be able to:

- Realize that there is a struggle between nature and the built environment
- Understand the far reaching impacts of landuse decisions
 - Recognize that landuse is directly related to water quality because of the nature of a watershed
- Begin to consider environmental stewardship

Materials

- Computer with PowerPoint and projection capabilities for the presentation
- Flipchart to list any questions that arise from the discussion

Pre-Class Set-up

Print out notes pages for the presentation (there is useful information). Check to be sure the equipment is functioning properly. This is primarily a presentation but be attentive to the audience to allow for some discussion so that the students remain focused.

Discussion

Refresh the students' memories of the bodies of water spatially relevant to Philadelphia

- Delaware River, Schuylkill River, Wissahickon Creek, Cobbs Creek

Provide the students with a brief background of the settlement patterns of Philadelphia

- Original city was bound by the rivers
- People moved to the suburbs – West Philadelphia and Germantown/Chestnut Hill
 - The Wissahickon Valley was settled to give the Wissahickon Creek the right of way
 - West Philadelphia was settled in strict adherence to the grid that William Penn established
 - *Ask the students what the major difference is between these two settlement patterns, especially in relation to the existing creeks.*

The Mill Creek Area

- In 1677 William Warner purchased a large tract of land which came to be known as Blockley Estates
 - As people moved out of the center city into the suburbs, they settled in this area, which became known as West Philadelphia (primarily south of Market (High) Street)
- As West Philadelphia became settled, most people avoided the Mill Creek area because of land quality and social issues.

- The mill town was in the floodplain – a swampy area full of society’s ills – industry, orphanage for colored children, psychiatric hospital, etc.
- As the city’s population increased, the less fortunate moved to Mill Creek. In any area, the poorest quality of land and housing, generally goes to the poorest people.
 - Mill Creek became a mixed-use area. Slaughter houses, industry and residences were neighbors.
- 1880 filling-in of the creek to create a sewer to protect public health
 - Many of Philadelphia’s creeks were polluted with industrial wastes and raw sewage. The water department began the process of filling in the creeks to protect the population from disease.
 - Often 40 feet of fill (ash) was used to bury the brick encased creek. Unfortunately, this was only a temporary solution because as development increased, little was done to the infrastructure of the buried creeks. This usually resulted in disaster.

Presentation

See attached PowerPoint File “A River Runs Through It”

Discussion/Evaluation

Relate a compromised watershed to stormwater runoff, etc. Talk about stormwater BMPs.

What practices in particular can potentially improve the quality of life? What suggestions do the students have for promoting environmental awareness in their neighborhood? Revisit other related topics covered in class or on field trips/action projects.

The History of Garbage - Timeline

This timeline can be used in place of *The History of Garbage* video. The history provides students with information about the development and importance of municipal waste collection. In addition, there is information about recycling and legislation pertinent to waste management. The red highlights indicate inventions that helped to increase our waste production.

500 BC – 1700s

- 10000 BC** Garbage becomes an issue as people first begin to establish permanent settlements
- 500 BC** The first municipal dump is established in ancient Athens
- 200** The first sanitation force is created by the Romans. Teams of two men walk along the streets, pick up garbage and throw it in a wagon.
- 1388** The English Parliament bans dumping of waste in ditches and public waterways.
- 1400** Garbage piles up so high outside Paris gates that it interferes with the city defenses.
- 1551** The first recorded use of packaging: German papermaker Andreas Bernhart begins placing his paper in wrappers labeled with his name and address.
- 1657** New Amsterdam (now Manhattan) passes a law against casting waste in the streets.
- 1690** The Rittenhouse Mill, America's first paper mill, opens in Philadelphia making paper from recycled cotton and linen as well as used paper.
- 1710** Colonists in Virginia commonly bury their trash. Holes are filled with building debris, broken glass or ceramic objects, oyster shells and animal bones. They also throw away hundreds of suits of armor that were sent to protect colonists from arrows of native inhabitants.
- 1776** The first metal recycling in America occurs when patriots in New York City melt down a statue of King George III and make it into bullets.
- 1757** Benjamin Franklin institutes the first municipal street cleaning service in the United States, in Philadelphia.

1800s

- 1800** Pigs loose in city streets throughout the country eat garbage and leave their own wastes behind.
- 1800** Visitors describe New York City as a "nasal disaster, where some streets smell like bad eggs dissolved in ammonia."
- 1810** The tin can is patented in London by Peter Durand.
- 1834** Charleston, West Virginia, enacts a law protecting vultures from hunters. The birds help eat the city's garbage.

- 1842** A report in England links disease to unsanitary environmental conditions, helping to launch the “age of sanitation”
- 1850** Junk dealers in Reno, Nevada scavenge personal belongings from the Oregon, Santa Fe and California trails. Pioneers abandoned the items on the long trek west.
- 1860** American newspapers are now printed on paper made from wood pulp fibers rather than rags.
- 1860** Residents of Washington, D.C. dump garbage and slop into alleys and streets, pigs roam freely, slaughterhouses spew nauseating fumes and rats and cockroaches infest most dwellings including the White House.
- 1866** New York City's Metropolitan Board of Health declares war on garbage, forbidding the "throwing of dead animals, garbage or ashes into the streets.
- 1868** Brothers I.S. and John Hyatt successfully manufacture "celluloid," the first commercial synthetic plastic. It replaces wood, ivory, metal and linen in such items as combs, billiard balls, eyeglasses and shirt collars.
- 1869** The first commercial plastic, called celluloid, was developed by an entrepreneurial maker of dental plates and novelty items. He had answered an ad placed by a supplier of billiards equipment offering a reward for developing a suitable replacement material for elephant ivory to make billiard balls
- 1872** New York City stops dumping its garbage from a platform built over the East River.
- 1874** In Nottingham, England, the “destructor” burns garbage and produces electricity. Ten years later, the first American incinerator opens in New York.
- 1879** Frank Woolworth opens the first five and dime store in Utica, New York. He pioneers the idea of displaying goods on open counters so customers can see and feel merchandise (a practice that later makes larger, theft proof packaging necessary).
- 1879** "Thither were brought the dead dogs and cats, the kitchen garbage and the like, and duly dumped. This festering, rotten mess were picked over by rag pickers and wallowed over by pigs, pigs and humans contesting for a living from it, and as the heaps increased, the odors increased also, and the mass lay corrupting under a tropical sun, dispersing the pestilential fumes where the winds carried them." - Minister describing the New Orleans dump to the American Public Health Association.
- 1880** Many Americans still believe that diseases such as typhoid fever are caused by "miasma" or gases coming from garbage and sewers.
- 1880** New York City scavengers remove 15,000 horse carcasses from the streets.
- 1885** The first garbage incinerator in the U.S. is built on Governors Island in New York Harbor.
- 1885-1908** 180 garbage incinerators are built in the United States.
- 1889** "Appropriate places for (refuse) are becoming scarcer year by year, and the question as to some other method of disposal...must soon confront us. Already the inhabitants in proximity to the public dumps are beginning to complain." - Health Officer's report, Washington, D.C.

- 1892** Beer bottles now sport a metal cap to prevent spoilage.
- 1893** "The means resorted to by a large number of citizens to get rid of their garbage and avoid paying for its collection would be very amusing were it not such a menace to public health. Some burn it, while others wrap it up in paper and carry it on their way to work and drop it when unobserved, or throw it into vacant lots or into the river." - Boston Sanitary Committee
- 1894** The citizens of Alexandria, Virginia are disgusted by the sight of barge loads of garbage floating down the Potomac River from Washington, D.C. They take to sinking the barges upriver from their community.
- 1895** The New York city street Cleaning Commissioner sets up the first comprehensive system for public sector garbage management in the country.
- 1895** King C. Gillette, a traveling salesman, invents a razor with disposable blades.
- 1896** Chicago's City Council records its concern for the death rate in the 19th Ward, which has eight miles of unpaved roads that can't be swept, roads "polluted to the last degree with trampled garbage, excreta and other vegetables and animal refuse of the vilest description."
- 1896** Waste reduction plants, which compress organic wastes to extract grease, oils, and other by-products, are introduced to the United States from Vienna, Austria. The plants are later closed, since they emit noxious odors.
- 1897** The first recycling center is established in New York City.
- 1898** Colonel George Waring, New York's Street Cleaning Commissioner, organizes the country's first rubbish sorting plant for recycling.
- 1899** The federal Rivers and Harbors Act restricts dumping in navigable rivers, to keep them open for shipping.

1900s

- 1900** American cities begin to estimate and record collected wastes. According to one estimate, each American produces annually: 80 - 100 pounds of food waste; 50 - 100 pounds of rubbish; 300 - 1,200 pounds of wood or coal ash - up to 1,400 pounds per person.
- 1900** Greater acceptance of the germ theory of disease begins to shift the job of garbage removal from health departments to public works departments. Health officers, it is felt, should spend their time battling infectious diseases, not cleaning up "public nuisances" such as garbage.
- 1900** Hills Brothers Coffee in San Francisco puts the first vacuum-packed coffee on the market.
- 1900** "Piggeries" are developed in small- to medium-sized towns in the United States. At these facilities, swine eat fresh or cooked food waste. It is estimated that 75 pigs consume 1 ton of refuse per day. Food waste is recycled as pig feed until the late 1960s.
- 1900** There are over 3 million horses working in American cities, each producing over 20 pounds of manure and gallons of urine per day, most of which is left on the streets.
- 1902** A survey of 161 cities by the Massachusetts Institute of Technology finds that 79% of them provide regular collection of refuse.

- 1903** Corrugated paperboard containers are now used commercially.
- 1904** Large-scale aluminum recycling begins in Chicago and Cleveland.
- 1904** Montgomery Ward mails out 3 million catalogues weighing four pounds each.
- 1904** Postmaster General Henry Clay Payne authorizes permit mail. This means that with a single fee, 2,000 or more pieces of third or fourth class mail can be posted without stamps. This opens the door for direct mail advertising and mass solicitations.
- 1905** New York City begins using a garbage incinerator to generate electricity to light the Williamsburg Bridge.
- 1907** An unexpectedly thick run of toilet paper is converted to become the first paper towels.
- 1908** Paper cups replace tin cups at water vending machines on trains and in public buildings.
- 1909** 102 of 180 incinerators built since 1885 are abandoned or dismantled due to noxious smoke. Many had been inadequately built or run. Also, American's abundant land and widely spaced population made dumping garbage cheaper and more practical.
- 1909** Kraft paper pulp first made in the United States, a process developed in Germany in 1883.
- 1910** City beautification programs become more and more popular. Many cities have juvenile sanitation leagues whose members promise to help keep streets and neighborhoods clean. Sanitation workers wear white uniforms, reminiscent of other public workers such as doctors and nurses.
- 1912** Cellophane (clear plastic) is invented by Swiss chemist Dr. Jacques Brandenberger, which encourages the use of plastic packaging.
- 1914** W.K. Kellogg invents a wax paper wrapper for Corn Flakes boxes.
- 1914** After a shaky start, incinerators increase in popularity in North American cities. About 300 incinerators operate in the United States and Canada.
- 1915** The National Clean-Up and Paint-Up bureau sponsors 5,000 local clean-up campaigns.
- 1916** Dr. Thomas Jasperson obtains a patent for making paper from de-inked wastepaper.
- 1916** Major cities estimate that of the 1,000 to 1,750 pounds of waste generated by each person per year, 80% is coal and wood ash.
- 1916** Cities begin switching from horse-drawn to motorized refuse collection equipment.
- 1916** Waxed paper is commonly used to wrap bread.
- 1917** Shortages of raw materials during World War I prompt the federal government to start the Waste Reclamation Service, part of the War Industries Board. Its motto is "Don't Waste Waste - Save it." Every article of waste is considered valuable for industry.

1920s-1939

- 1920** During this decade, “reclaiming” or filling wetlands near cities with garbage, ash and dirt becomes a popular disposal method. Garbage is placed in the wetlands in layers, with ash and dirt layers on top as cover.
- 1920** The first commercial radio broadcast. The technology held far reaching implications for advertising and purchasing. Americans buy 1.5 million radios within the year.
- 1924** The Kleenex facial tissue is introduced.
- 1926** Clarence Saunders opens the first supermarket. Pre-packaged food and self service packaging increases selection for consumers and lowers the cost of food.
- 1928** Cellophane is invented by the DuPont Cellophane Company. The transparent material is used as a protective wrapping for food and other products.
- 1928** Teleprinters and teletypewriters come into use.
- 1929** Aluminum foil is invented.
- 1930** A new plastic, polyvinyl chloride, is patented by B.F. Goodrich. It is used as a replacement for rubber, as protection against corrosion and for adhesives.
- 1930** Another plastic, polystyrene, is put on the market by a German firm, I.G. Farben, and also produced by Dow Chemical Company. The hard, shiny material is molded into tackle boxes, refrigerator linings and other items.
- 1930** Kimberly Clark develops disposable sanitary pads.
- 1932** The development of compactor garbage trucks increases vehicle capacity.
- 1933** Communities on the New Jersey shore obtain a court order forcing New York City to stop dumping garbage in the Atlantic Ocean. On July 1, 1934, the Supreme Court upholds the lower court action, but applies it only to municipal waste, not commercial or industrial wastes.
- 1935** Rohm and Haas invents Plexiglass, a clear plastic used in headlights, lenses, windows, clocks and jewelry.
- 1935** General Electric begins producing and marketing a garbage “Disposal.”
- 1935** The first beer can is produced by Kreuger’s Cream Ale in Richmond, VA. Over the next six months, company sales increased 550% because customers loved the convenience.
- 1936** Milk products are now commonly sold in paper packaging.
- 1937** The DuPont Company patents nylon, the world’s first synthetic fiber. Its strength, resistance to moisture and mildew, and good recovery after stretching lead to its use in stockings, electrical parts, power tools and car accessories.
- 1939** Coal and wood ash make up 43% of New York City’s refuse, down from 80% in 1916.
- 1939** Paperback books are introduced, selling for 25 cents.

1939 Wisconsin Select beer is sold in no deposit, no return bottles to compete with the recent introduction of beer in no return cans.

1939 Birds Eye introduces the first pre-cooked frozen foods – chicken fricassee and criss cross steak.

1940s

1940 The Fresno, California, Director of Public Works leads the effort in developing sanitary methods for disposing of trash in large urban areas.

1940 Japanese conquests in Southeast Asia cut off America's supply of tin, hampering canned food production.

1941 America enters World War II. Rationing of such materials as wood and metal forces an increased reliance on synthetic materials such as plastics. Low-density polyethylene film, developed during wartime, replaces cellophane as the favorite food wrap by 1960.

1942 Americans collect rubber, paper, glass, metals and fats —about 25 percent of the waste stream—to help the war effort. Paper collections are so successful they overwhelm the markets by the spring of 1942.

1942 Methods and materials for wartime shipment of food make World War II "the great divide" in the packaging and storage industry.

1943 The aerosol can is invented by two researchers at the U.S. Department of Agriculture.

1944 Styrofoam is invented by Dow Chemical Co.

1945 During the war, Army troops bury trash in the ground, providing the initial idea for the "sanitary landfill."

1945 The first American ballpoint pens go on sale for \$12.50 each at Gimbel's in New York.

1946 Fortune Magazine heralds the arrival of the "dream era....The Great American Boom is on."

1947 "Our willingness to part with something before it is completely worn out is a phenomenon noticeable in no other society in history...It is soundly based on our economy of abundance. It must be further nurtured even though it runs contrary to one of the oldest inbred laws of humanity, the law of thrift." - J. Gordon Lippincott, industrial designer

1948 American Public Health Association predicts that the garbage disposal will cause the garbage can to "ultimately follow the privy" and become an "anachronism."

1948 Fresh Kills landfill is opened in Staten Island, New York. It later becomes the world's largest city dump. Fresh Kills and the Great Wall of China are the only man-made objects visible from space.

1950s

- 1950** Many urban areas use close-in, open-burning dumps because they reduced the volume of refuse and extend the usability of the site. But by the end of the decade, open burning of refuse is prohibited in many areas.
- 1950** A second hydraulic system to eject garbage is added to garbage trucks.
- 1950** An improved paper cup for hot beverages is introduced. It is lined with polyethylene instead of wax.
- 1950** The growth of convenience foods (frozen, canned, dried, boxed, etc) increases the amounts and changes the types of packaging thrown away.
- 1953** The American economy's "ultimate purpose is to produce more consumer goods." - Chairman of President Eisenhower's Council of Economic Advisors.
- 1953** Swanson introduces the first successful TV dinner: turkey, mashed potatoes and peas.
- 1954** "Never underestimate the buying power of a child under seven. He has brand loyalty and the determination to see that his parents purchase the products of his choice." - Dr. Frances Horwitch ("Miss Frances" of TV's Ding Dong School) at Chicago advertising conference.
- 1954** Olympia, Washington, enacts one of the first "pay-per-can" programs.
- 1955** With consumer prosperity at an all-time high in the United States, Life magazine heralds the advent of the "throwaway society."
- 1958-1976** The amount of packaging produced and disposed of in the United States increases by 67 percent, due to the increase in consumerism after World War II.
- 1957** High-density polyethylene (HDPE) is developed by Standard Oil of Indiana and Phillips Petroleum (now used for milk containers.)
- 1958** The Bic Crystal Company introduces the throwaway pen.
- 1959** Philadelphia closes its reduction plant (a facility for turning organic wastes into fats, grease and oils) the last one in the country.
- 1959** The American Society of Civil Engineers publishes a standard guide to sanitary landfilling. To guard against rodents and odors, it suggests compacting the refuse and covering it with a layer of soil each day.
- 1959** The first photocopier, the Xerox 914, is introduced - 22 years after it was patented.

1960s

- 1960** Bead molded polystyrene cups are introduced. They provide better insulation for hot drinks.
- 1960** Bread is sold bagged in polyethylene rather than wrapped in waxed paper.
- 1960** Easy open tops (pop tops) for beverage cans are invented. Iron City Beer in Pittsburgh is the first to try the invention and sales increase immediately.
- 1960** The first disposable razors are sold.
- 1961** Sam Yorty runs successfully for mayor of Los Angeles on a platform to end the inconvenience of separating refuse. A city ordinance eliminates the sorting of recyclables.
- 1963** The aluminum can for beverages is developed.
- 1965** The first federal solid waste management law, the Solid Waste Disposal Act, authorizes research and provides for state solid waste grants. These include site inventory programs, resource recovery systems, and constructing new or improved solid waste disposal facilities.
- 1968** President Lyndon Johnson commissions the National Survey of Community Solid Waste Practices, which provides the first comprehensive data on solid waste since cities began to record amounts and types of waste in the early 1900s. More than 33 percent of U.S. cities collect waste that is separated in some manner.
- 1968** The U.S. aluminum industry begins recycling discarded aluminum products, from beverage cans to window blinds.
- 1969** Seattle, Washington institutes a new fee structure for garbage pick up. Residents pay a base rate for one to four cans and an additional fee for each additional bundle or can.

1970s

- 1970** The Federal Clean Air Act enacted. New regulations lead to incineration shut downs.
- 1970** The first Earth Day. Millions of people rally nationwide on April 22.
- 1970** The U.S. Environmental Protection Agency (EPA) is created by President Nixon. Its first Administrator is William Ruckelshaus.
- 1971** Oregon passes the nation's first bottle bill, paving the way for nine other states to offer refunds of 5 or 10 cents for returned containers. By offering cash for aluminum, glass and plastic containers, it removes about 7% of its garbage from the waste stream.

- 1972** According to William Ruckelshaus, head of EPA, solid waste management is a "fundamental ecological issue. It illustrates, perhaps more clearly than any other environmental problem, that we must change many of our traditional attitudes and habits."
- 1972** The Federal Clean Water Act is enacted to restore and maintain the chemical, physical and biological integrity of the nation's waters.
- 1972** The first buy-back centers for recyclables are opened in Washington State. They accept beer bottles, aluminum cans and newspapers.
- 1974** The first city-wide use of curbside recycling bins occurs in University City, Missouri for collecting newspapers.
- 1975** All 50 states have some form of solid waste regulations in place, although the requirements vary widely
- 1975** "That happiness is to be attained through limitless material acquisition is denied by every religion and philosophy known to humankind, but is preached incessantly by every American television set." - Robert Bellah, *The Broken Covenant*.
- 1976** The Resource Conservation and Recovery Act creates the first significant role for federal government in waste management. It emphasizes recycling and conservation of energy.
- 1976** The Resource Conservation and Recovery Act is passed, which requires all dumps to be replaced with "sanitary landfills." The enforcement of this act will increase the cost of landfill disposal, and that will make resource-conserving options like recycling more appealing.
- 1976** The Toxic Substances Control Act is passed. Before this and the Resource Conservation and Recovery Act went into effect, any individual or business could legally dump any kind and amount of hazardous chemicals in landfills.
- 1976** Three people from Bartlesville, Oklahoma get a patent on a method for purifying and reusing lubricating oils.
- 1977** Polyethylene terephthalate (PET) soda bottles are introduced to replace glass bottles. The plastic was first developed in England in 1941.
- 1978** The Supreme Court rules that garbage is protected by the Interstate Commerce Clause; therefore, one state cannot ban shipments of waste from another.
- 1979** EPA prohibits open dumping and sets first standards for landfills.

1980s

- 1980** Polypropylene is introduced and used for butter and margarine tubs and for drinking straws.
- 1980** The first community-wide household hazardous waste collection day is held.
- 1983** The space shuttle is pulled out of service to replace a window that had been severely pitted by a chip of paint from space junk.

- 1984** During the Olympic Games in Los Angeles, athletes, trainers, coaches and spectators produce 6.5 million pounds of trash in 22 days, more than six pounds per person per day.
- 1984** Hazardous and Solid Waste Act amendments and reauthorization to the Resource Conservation and Recovery Act require tougher federal regulation of landfills.
- 1986** Fresh Kills, in Staten Island, New York, becomes the largest landfill in the world.
- 1986** Rhode Island becomes the first state to pass mandatory recycling laws for aluminum and steel cans, glass, newspapers and #1 and #2 plastic.
- 1986** Rhode Island enacts the nation's first statewide mandatory recycling law.
- 1986** The city of San Francisco meets its goal of recycling 25% of its commercial and residential waste.
- 1987** The Garbage Project at the University of Arizona, Tucson begins to excavate modern landfills as if they were ancient archaeological sites. The goal is to determine exactly what is inside landfills and how much of it biodegrades.
- 1987** Mobro, the garbage barge, sails from New York up and down the U.S. East Coast, looking for a place to dispose of its waste. Rejected by facilities in six states and three countries, the barge draws public attention to the perceived landfill capacity shortage in the Northeast. The garbage is finally incinerated in Brooklyn and the ash is disposed of in a landfill near Islip, Long Island.
- 1988** "Nobody ever has enough." - Lewis Lapham, *Money and Class in America*.
- 1988** The EPA estimates that more than 14,000 landfills have closed since 1978, more than 70% of those operating at that time. The landfills were full, unsafe or the owners declined to adhere to new standards.
- 1988** The Plastic Bottle Institute develops a material-identification code system for plastic bottle manufacturers (this is our current #1-#7 system).
- 1989** EPA issues "An Agenda for Action," calling for an integrated solid waste management approach to solving solid waste problems with waste problems, with waste prevention and recycling as its first two priorities. EPA sets a 25 percent national waste reduction and recycling goal.
- Twenty-six states have comprehensive laws making recycling an integral part of solid waste management.

1990s-present

- 1990** 140 recycling laws enacted in 38 states and the District of Columbia.
- 1990** McDonald's announces plans to stop the use of Styrofoam packaging of its food due to consumer protests.
- 1990** Neither shortening nor lengthening product life can be a general principle. The strategy, rather, is to fine tune the durations of things, now avoiding cheap things that break too soon and clog our trash cans, now expensive objects that last too long and clog our lives." - Kevin Lynch, *Wasting Away*.
- 1990** On December 4, both Coca-Cola and Pepsi announced that they will begin using a recycled PET (#1 plastic) bottle made of about 25% recycled plastic resin.

- 1991** EPA sets improved solid waste landfill standards that include requirements for location, groundwater protection, monitoring, and post-closure care. EPA also issues new performance and emissions standards for MSW combustors.
- More than 3,000 household hazardous waste community collection programs have been documented in all 50 states.
- 1991** "Our economy is such that we cannot 'afford' to take care of things: labor is expensive, time is expensive, money is expensive, but materials - - the stuff of creation - - are so cheap that we cannot afford to take care of them." - Wendell Berry
- 1992** President Bush issues Executive Order 12780, to stimulate waste reduction, recycling, and procurement of recycled goods in all federal agencies.
- 1993** Municipal Solid Waste landfill criteria become effective for most landfills in the U.S.
- 1993** "We're reminded a hundred times a day to buy things, but we're not reminded to take care of them, repair them, reuse them or give them away." - Michael Jacobson, Center for the Study of Commercialism
- 1994** EPA launches the Waste Wise to help businesses, educational institutions, and other large facilities reduce waste and recycle more materials.
- EPA launches its Jobs Through Recycling initiative to bring together the economic development and recycling communities through grants, networking, and information sharing.
- President Clinton issues Executive Order 12873, which requires federal agencies to establish waste prevention and recycling programs and to buy and use recycled and environmentally preferable products and services. Clinton creates the Office of the Federal Environmental Executive to enforce this Executive Order.
- 1995** EPA issues the first Comprehensive Procurement Guideline, designating 19 recycled-content products for which the federal government should give procurement preference.
- 1996** The nation reaches a 25 percent recycling rate. EPA sets a new recycling goal of 35 percent.
- The first voluntary recycling and composting initiatives are held at the Olympics, at the 1996 Olympic Games in Atlanta. Organizers aim to divert 12 million aluminum cans, 20 million PET bottles, and 3,000 tons of paper for recycling.
- 1999** EPA's Municipal Solid Waste in the United States: Facts and Figures, updated ever year, provides data on U.S. waste generation, recover, and disposal rates.
- 2000** EPA establishes a link between global climate change and solid waste management, showing that waste reduction and recycling help stop global climate change.
- More than 5,000 U.S. cities are using Pay-As-You-Throw Programs, in which residents pay for MSW collection based on the amount of waste they throw away—encouraging recycling and waste reduction.
- 2001** EPA policy requires its offices to use paper with 100-percent recycled content and 50-percent postconsumer content.
- 2002** EPA kicks off Resource Conservation Challenge urging Americans to meet or beat two goals by 2005: boosting the national recycling rate from 30 percent to at least 35 percent and curbing by 50 percent the generation of 30 harmful chemicals normally found in hazardous waste.